

LIFE HISTORY OF THE RED OAK BORER, *ENAPHALODES RUFULUS* (HALDEMAN), IN WHITE OAK (COLEOPTERA: CERAMBYCIDAE)¹

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ABSTRACT: Young red oak borer larvae feed horizontally in white oak but mostly vertically in red, black, and scarlet oak. Overgrowths of successful attacks in white oak appear as "L" or reverse "L" marks on the trees. In a study in central and southern Ohio between 1977 and 1981, 27 of 457 trees examined in the basal 6 feet had borer injuries. Only small, suppressed trees were injured.

The life history of the red oak borer, *Enaphalodes rufulus* (Haldeman), in red, *Quercus rubra* L., black, *Quercus velutina* Lam., and scarlet oak, *Quercus coccinea* Muenchh., was reported by Hay (1969). Donley and co-workers (1969) reported red oak borer damage in white oak, *Quercus alba* L. However, the behavior of the red oak borer in white oak was not reported.

Methods

The basal 6 feet of 457 living white oak trees, ranging from 5 to 45 cm dbh, were examined in central and southern Ohio between 1977 and 1981. Twenty-seven trees had evidence of red oak borer attacks. Diameter breast height (dbh) measurements of the attacked trees were taken; the trees were cut and average annual diameter growth for the last 10 years was recorded. The trees were sectioned and debarked, and the number of attacks that damaged the xylem were recorded. Sections with attacks that went deep into the xylem were split open to see if long slivers (10 to 25 mm) of wood remained in the larval galleries indicating successful adult emergence. In addition, 27 other randomly chosen trees without attacks were cut, and their average annual diameter growth during the last 10 years was recorded.

The life history of the red oak borer in white oak was determined as follows: 10 mated females were caged individually in hardware cloth sleeve cages on 10 white oaks, 10 to 15 cm dbh, in July of 1979. The beetles had been reared artificially using techniques reported by Galford (1974). The beetles were F₁ and F₂ offspring of parents that had emerged from a white oak tree. In November of 1979, and June and November 1980, 10 of the attack sites on the trees were exposed and measurements of larval damage were made. In August of 1981 the remaining attack sites were examined to see if adult emergence had occurred.

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Results

The mean dbh of the 27 naturally attacked trees was 9.9 cm and ranged from 7.1 to 18 cm. Mean number of attacks per tree that damaged the xylem was 7, ranging from 2 to 14. Mean number of adult emergents per tree was 1.4 and ranged from 0 to 4. Average annual diameter growth of the attacked trees during the last 10 years was 2 mm, ranging from less than 1 mm to 4 mm.

Average annual diameter growth for the 27 trees without attacks was 6 mm, ranging from 2 mm to 9 mm. The mean dbh of these trees was 13 cm and ranged from 7 to 28 cm.

As a result of caging the 10 females on 10 different trees, 46 attacks were detected on 4 of the trees. Thirty of the attacks were exposed to make measurements, and the larvae were killed in the process. Only 2 of the remaining 16 larvae survived to become adults.

Observations and measurements of attacks that occurred as a result of caging females on trees led to the following conclusions: the newly hatched larvae mine in the cambium area horizontally around the tree from late July and early August until cold weather arrives, and then overwinter. Damage in the phloem-cambium region ranges from roughly circular areas about 5 mm in diameter to horizontal lines 2 to 3 mm wide and 6 to 15 mm long.

During the spring of the next year, the larvae continue to feed horizontally around the tree until late June or early July. Horizontal feeding now extends 40 to 75 mm around the tree. The larvae then feed upward widening the gallery and begin to score the xylem more heavily. After feeding upward for 75 to 125 mm, the larvae bore obliquely into the xylem about 30 to 50 mm, then vertically for 100 to 150 mm. In the fall, the larvae plug the holes with wood slivers and overwinter behind the plugs. The following spring the plugs are removed and replaced with other plugs behind which the larvae pupate. Sometimes the overwintering plugs are not removed, and pupation occurs without new plugs being made.

When emerging, the adults gnaw and rip the plugs out, pushing some of the wood slivers behind them. Long slivers of wood often extrude from the emergence hole indicating adult emergence. Figure 1 illustrates borer damage in white oak.

When white oak trees are vigorous enough to overgrow borer injuries, the overgrowths resemble an "L" or reverse "L" (Figure 2). One attack was found that did not have a horizontal feeding scar, but this was exceptional.

Discussion

In southern and central Ohio, 27 of 457 white oak trees examined had external evidence of red oak borer damage. These were suppressed, very

slow-growing trees. In Ohio, either the red oak borer does not readily attack white oak, or the larvae can survive only in very suppressed trees.

The red oak borer has a 2-year life cycle in white oak, the same development period as Hay (1969) observed in red, black, and scarlet oak.

The difference in feeding habits of young larvae in white oak versus red, black, and scarlet could be due to the very thin layer of phloem in slow-growing white oaks, or there could be a strain of red oak borers that prefers or attacks only white oak.



Fig. 1. Horizontal feeding scar caused by red oak borer larva during first year of development.

LITERATURE CITED

- Donley, D.E.; Hay, C.J.; Burns, D.P. 1969. Borers in Ohio oaks. *Ohio Woodlands* 7(4): 17-18.
- Galford, J.R. 1974. Some physiological effects of temperature on artificially reared red oak borers. *J. Econ. Entomol.* 67: 709-710.
- Hay, C.J. 1969. The life history of a red oak borer and its behavior in red, black, and scarlet oak. *Proc. North Cent. Branch Entomol. Soc. Am.* Vol. 24(2): 125-127.



Fig. 2. Red oak borer attacks on white oak almost overgrown with callus tissue.